The Formation, Alteration and Preservation of Flood Deposits on the Pacific Northwest Continental Margin

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LONG-TERM GOALS

The ultimate objective of this research program is to obtain a predictive understanding of the physical and biological processes responsible for the formation, alteration and preservation of sedimentary event deposits. The general approach is the development and testing of theory mainly through field observations and measurements.

OBJECTIVES

This is a project to study the formation, post-depositional alteration and preservation of flood deposits on the Pacific Northwest continental margin. Five related activities are being pursued: (1) continuation of time series measurements of the areal distribution and small-scale properties of the 1995 and 1997 Eel River flood deposits, (2) statistical analysis of the small-scale spatial variability of flood bed thickness and geometry at stations K60 and S60, (3) x-radiographic examination of piston cores for past flood deposits, (4) testing of simple conceptual ideas of event layer alteration and preservation using the above data sets, and (5) examination of patterns of sediment accumulation and event-layer preservation offshore of other Pacific Northwest rivers.

APPROACH

A box corer is the primary seafloor-sampling device used in this research. Cores are taken in two different modes: (1) replicate time-series sampling, and (2) broad, large-scale coverage of river margins. Subsequent sources of data include digital x-radiographs, microresistivity profiles, profiles of the radionuclides, Pb-210, Cs-137, Be-7 and Th-234, and macrofaunal community composition, abundance and biomass. Past sampling has focused on sites offshore the Eel River (northern California) and several other major rivers in the Pacific Northwest (e.g., Russian, Klamath, Umpqua), and now, over the past year, the Po River margin in the northern Adriatic Sea.

WORK COMPLETED

FY 01 was intended to be an analysis and writing year with no planned field activities. However, a historically significant flood on the Po River occurred in late October 2000. Because this flood occurred in one of the likely field areas of the nascent EuroSTRATAFORM Program, and because of its intrinsic value toward understanding flood layer formation and alteration, an event-response sampling effort was mounted. Cruises were conducted in early December 2000 and June 2001. During these cruises a series of roughly 30 stations were occupied adjacent to the mouths of the Po River. Box cores collected at these stations were subsampled for a range of measurements (see above).

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15. SUBJECT TERMS

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RESULTS

The Po margin event-response cruises were extremely successful, and results from these cruises provide important contrasts to the Eel River flood deposits (Wheatcroft et al., 2001). Both the Eel and the Po flood deposits have unique (relative to the ambient sediments) sedimentological and geochemical properties. In particular, both are extremely fine-grained (clay-rich), have a high porosity and are enriched in Be-7 (an indicator of terrestrial sediment). Important small-scale differences between the Eel and Po flood deposits include the presence of a much greater diversity of physical sedimentary structures (e.g., soft-sediment deformation structures, laminations, thick beds) in the Po flood deposit (Figure 1). The most significant difference between the two flood deposits is their large-scale distribution. The centers of mass of the Eel River flood deposits are displaced roughly 15 km from the river mouth. In addition, the Eel flood deposits tend to have gentle thickness gradients that suggest active redistribution during their emplacement. In contrast, the center of mass of the Po flood deposit is immediately offshore of the river mouths (within a few km) and there are sharp thickness gradients. The latter suggests little redistribution during emplacement. The primary cause of the difference between the Eel and Po flood deposits is likely to be the size of the river basin, whereby small systems such as the Eel discharge their sediment during the storm that produced the flood. In contrast, large systems like the Po can deliver their flood sediment into oceanographically quiescent settings.

IMPACT/APPLICATIONS

Documenting the initial distribution and subsequent modification of sedimentary event beds, as well as patterns of sediment accumulation will provide key insight for modelers of strata development on continental margins.

TRANSITIONS

None.

RELATED PROJECTS

Po margin coring has been a joint effort with Nittrouer (UW), Hill (Udal) and Milligan (BIO), as well as personnel at the Istituto di Geologia Marina (CNR) in Bologna, Italy (Miserocchi and Trincardi).

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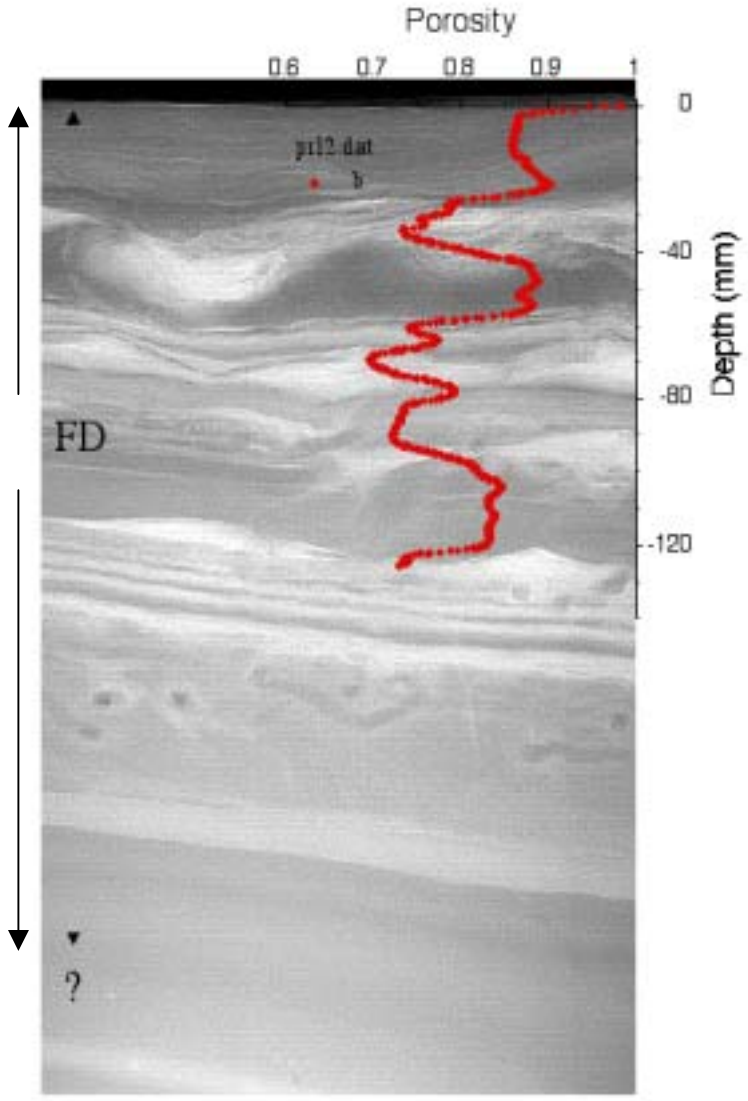

Figure 1. A digital x-radiograph of the Po River flood deposit (12-m station off the main river mouth) showing multiple layers with soft-sediment deformation structures, lenticular bedding and very few biogenic structures. Superimposed on the x-radiograph is a trace of porosity showing the extremely high values within the flood deposit.

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